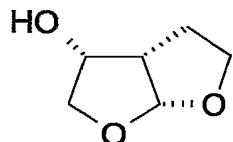


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Claims

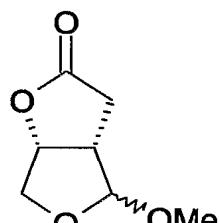
1. A method for the synthesis of (3R,3aS,6aR) hexahydro-furo[2,3-b]furan-3-ol having the structure of formula (6),



5

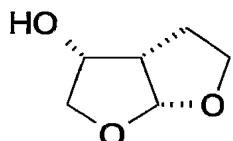
(6)

which method comprises the use of intermediates of formula (4).



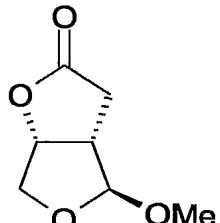
(4)

2. A method for the synthesis of (3R,3aS,6aR) hexahydro-furo[2,3-b]furan-3-ol having
10 the structure of formula (6),



(6)

which method comprises the use of intermediate of formula α-(4).



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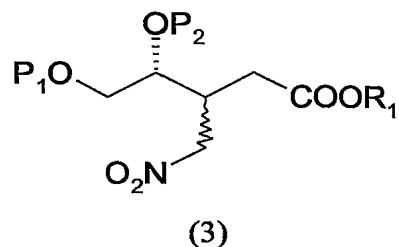
α-(4)

3. A method according to claim 1 which method comprises the steps of:

- a) treating compound of formula (3) with a base and subsequently with an acid in the presence of methanol;

20

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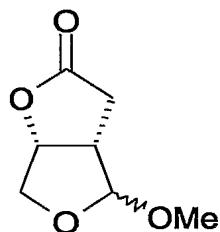
wherein

P¹ and **P²** are each independently a hydrogen, a hydroxy-protecting group or

5 may together form a vicinal-diol protecting group,

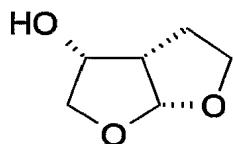
R¹ is alkyl, aryl or aralkyl;

resulting in intermediates of formula (4); and



10

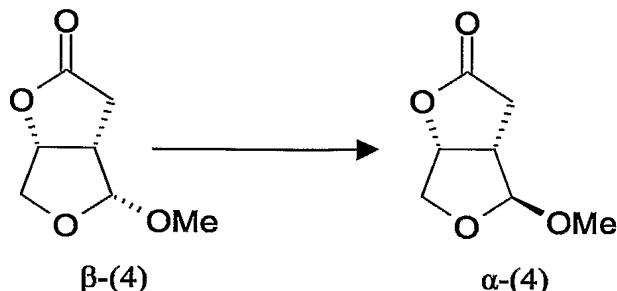
- b) reducing intermediates of formula (4) with a reducing agent and applying an intramolecular cyclization reaction to obtain compound of formula (6).



15

4. A method according to any one of claims 1 to 3 which method further comprises crystallizing intermediate of formula α-(4) with a solvent prior to the reduction thereof.
- 20
5. A method according to any one of claims 1 to 4 which method further comprises
 - a) epimerizing with acid intermediate of formula β-(4) into the intermediate of formula α-(4); and

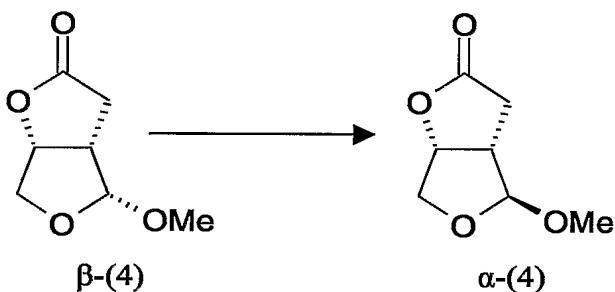
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- 5 b) crystallizing intermediate of formula $\alpha\text{-(4)}$ with a solvent prior to the reduction thereof.

6. A method according to claim 4 which method further comprises after crystallizing intermediate of formula $\alpha\text{-(4)}$,

- 10 a) epimerizing with acid intermediate of formula $\beta\text{-(4)}$ in the mother liquor of said crystallization into the intermediate of formula $\alpha\text{-(4)}$; and



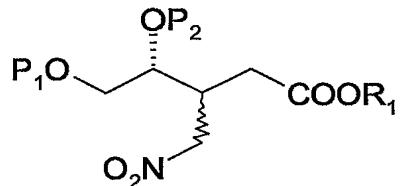
- 15 b) crystallizing intermediate of formula $\alpha\text{-(4)}$ with a solvent; prior to the reduction thereof.

7. A method according to any one of claims 5 to 6 wherein the epimerization of compound of formula $\beta\text{-(4)}$ to compound of formula $\alpha\text{-(4)}$ and crystallization of compound of formula $\alpha\text{-(4)}$ occur simultaneously.

- 20 8. A method according to claim 7, wherein the simultaneous epimerization of compound of formula $\beta\text{-(4)}$ to compound of formula $\alpha\text{-(4)}$ and the crystallization of compound of formula $\alpha\text{-(4)}$ is performed in methanol in the presence of an acid by evaporation or partial evaporation of the methanol.
- 25 9. A method according to claim 1 which method comprises the steps of:

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- 5 a) treating compound of formula (3) with a base and subsequently with an acid in the presence of a non-methanolic solvent; and subsequently reacting with methanol under acidic conditions;



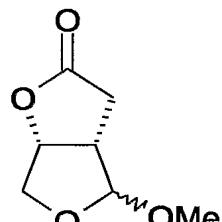
wherein

P¹ and **P²** are each independently a hydrogen, a hydroxy-protecting group or may together form a vicinal-diol protecting group,

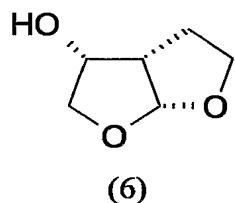
R¹ is alkyl, aryl or aralkyl;

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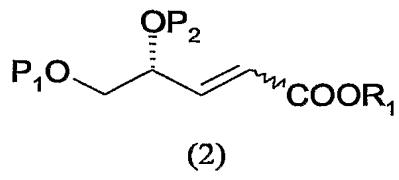
resulting in intermediates of formula (4); and



- 15 b) reducing intermediate of formula (4) with a reducing agent and applying an intramolecular cyclization reaction to obtain compound of formula (6).



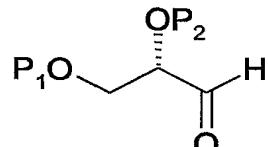
- 20 10. A method according to any one of claims 3 and 9 wherein compounds of formula (3) are obtained by reacting compounds of formula (2) with nitromethane and a base.



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11. A method according to claim 10 wherein compounds of formula (2) are obtained by condensing an intermediate of formula (1) or its hydrate, hemihydrate or a mixture thereof with phosphonates of the formula $(R^6O)_2P(=O)-CH_2-C(=O)OR^1$, wherein

5 P^1 and P^2 are as defined in claim 2,
 R^1 is as defined in claim 2,
 R^6 is alkyl, aryl or aralkyl,



(1)

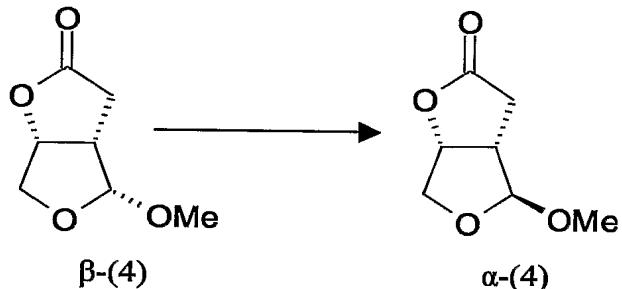
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12. A method according to any one of claims 3, 9, 10, and 11 wherein P^1 and P^2 together form a dialkyl methylene radical.
13. A method according to claim 10 wherein the base employed for the conversion of 15 compounds of formula (2) into compounds of formula (3) is DBU or TMG or derivatives thereof.
14. A method according to claim 11 wherein the phosphonate of the formula $(R^6O)_2P(=O)-CH_2-C(=O)OR^1$ is triethyl phosphonoacetate (TEPA).
- 20 15. A method according to any one of claims 3 and 9 wherein the conversion of compounds of formula (3) into compounds of formula (4) is performed with a base selected from the group of sodium methoxide, lithium methoxide, DBU or TMG or mixtures thereof.
- 25 16. A method according to any one of claims 10 and 13, wherein the conversion of compounds of formula (2) into compounds of formula (4) is performed by using DBU or TMG as the base in the conversion of compounds of formula (2) to compounds of formula (3), not isolating compounds of formula (3) and using sodium or lithium methoxide as additional base in the conversion of compounds of formula (3) to compounds of formula (4).
- 30 17. A method according to any one of claims 3, 9, 15 and 16 wherein the acid employed in the conversion of compounds of formula (3) into compounds of

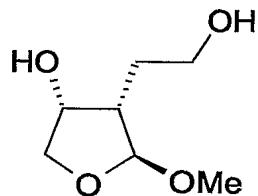
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formula (4) is concentrated sulphuric acid in an amount of 2.5 to 5 equivalents based on compound of formula (2) as a 20 to 80 wt% solution in methanol.

- 18. A method according to any one of claims 4 to 8 wherein crystallization of
5 compound of formula α -(4) is performed in an alcohol.
- 19. A method according to claim 18 wherein the alcohol is isopropanol, t-amyl alcohol or t-butanol.
- 10 20. A method for the conversion of compound of formula β -(4) into the compound of formula α -(4) which comprises an epimerization with acid.



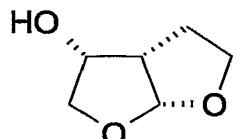
- 15 21. A method according to any one of claims 5 to 8 and 20 wherein epimerization of compound of formula β -(4) into compound of formula α -(4) is performed with 0.05 to 1.5 equivalents of MeSO_3H in methanol.
- 20 22. A method according to any one of claims 5 to 8 and 20 to 21 wherein the epimerization is performed at a temperature between 40°C and reflux temperature.
- 23. An intermediate having the formula α -(4).
- 24. An intermediate having the formula β -(4).
- 25 25. An intermediate with formula α -(4) in crystalline form.
- 26. An intermediate having the formula (5)



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(5)

27. Use of compound of formula (6) obtained by the methods according to any one of claims 1 to 18 in the preparation of [(1*S*,2*R*)-3-[[[(4-aminophenyl)sulfonyl](2-methylpropyl)amino]-2-hydroxy-1-(phenyl-methyl)propyl]-carbamic acid (3*R*,3a*S*,6a*R*)-hexahydrofuro[2,3-*b*]furan-3-yl ester.



(6)